

Industrial Farming: Implications for Human Health, with Peter Thorne

Ernie Hood

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Industrial-scale farms known as concentrated animal feeding operations (CAFOs) have become an increasing focal point for environmental health research because of their emissions and concerns they may contribute to antibiotic resistance, adverse community impacts, and zoonotic disease outbreaks. They are also a source of political controversy in states including North Carolina and Missouri where government agencies are grappling with decisions about CAFO monitoring and permitting. In this podcast, Peter Thorne describes some of the health concerns surrounding these facilities. Thorne, director of the NIEHS-funded Environmental Health Sciences Research Center at the University of Iowa, is the lead author of an *EHP* mini-monograph on environmental health effects of CAFOs.

AHEARN: It's *The Researcher's Perspective*. I'm Ashley Ahearn.

CAFOs, or Concentrated animal feeding operations, have stirred up political controversy in states such as North Carolina, Iowa, and Missouri, among others. CAFOs are large-scale industrial feedlots where animals like cows, chickens, and pigs are raised for slaughter. And in recent years CAFOs have become a focal point in environmental health research.

Dr. Peter Thorne is a professor of occupational and environmental health at the University of Iowa and is director of the Environmental Health Sciences Research Center there. Thorne studies the potential environmental and public health impacts of concentrated animal feeding operations and he started off by telling science writer Ernie Hood what makes a CAFO a CAFO.

THORNE: A CAFO is usually defined by the number of animals at the operation. So for water quality permits the EPA [U.S. Environmental Protection Agency] defines a CAFO as an operating location where animals are confined for 45 days or more and with at least 1,000 beef cattle, or 2,500 swine, or 55,000 turkeys, or 100,000 broiler chickens.

So one of the production challenges with CAFOs is what to do with the 500 million tons of manure produced annually. And this manure is typically held in deep pits beneath a

slatted floor where the animals are housed, or it's pumped out to large cesspools that are typically called "lagoons." And from these lagoons there's a significant loss of toxicants to the air, and if this manure is then aerial-sprayed onto croplands, there's transport of this material as toxic gases. If instead this manure slurry is injected directly into the soil or placed on a larger amount of land, that's considered a more sustainable operation that doesn't produce some of the problems associated with CAFOs.

HOOD: So Dr. Thorne, why has so much attention recently become focused on the potential environmental hazards associated with CAFOs?

THORNE: Well, first of all there's a huge body of science that shows that working in CAFOs causes occupational lung diseases, and there's some evidence to suggest that these same toxicants can cause health problems for those living nearby in CAFOs. Secondly, raising poultry and swine in close proximity in CAFOs is believed to heighten the risk of influenza pandemics. And third, the practices of feeding antibiotics to animals for growth production appears to contribute to the emergence of antibiotic-resistant bacteria, and this then raises the specter of human medicines not being effective for combating infection. And then lastly, industrialized livestock production generates large amounts of greenhouse gases, and so there is concern about this as part of the movement towards controlling and adapting to global climate change.

HOOD: What are the airborne exposures that have been associated with CAFOs, and how much of a hazard do they represent?

THORNE: Well, what we get the most calls and complaints about is odors that are experienced by rural residents, and the odors really represent a complex mixture of dozens of toxic compounds that trigger olfaction and are perceived by rural residents as putrid or fetid or rancid. But they also have health consequences associated with them.^{i,ii,iii,iv,v,vi} We also are concerned with hydrogen sulfide and ammonia, and a number of states have regulated hydrogen sulfide and ammonia as toxic gases emanating from CAFOs. A third area that gets attention is microbial contaminants, particularly bacterial endotoxin, and it appears that this is more of a concern for those who work in or near the

CAFOs than actually for people living downwind. But we have measured all of these compounds downwind in the environment from swine operations. The health effects that people complain about, typically, are irritation of the eyes, nose, and throat, exacerbation of asthma symptoms, and emotional stress.

HOOD: I see. And that's actually an area that you personally have conducted quite a bit of research in, correct?

THORNE: Yea, especially with those who work inside facilities where they have exposure to these agents.

HOOD: What about the impacts on water quality?

THORNE: Yea so, water quality concerns arise in several different areas. One of them is the nutrient contamination, or manure runoff, if you will, that can lead to fish kills, eutrophication of water, and toxic algal blooms. This has been a problem in parts of North Carolina as well as Iowa. An emerging area of concern is veterinary pharmaceuticals that can contaminate water. There's concern about human pharmaceuticals, so of course veterinary pharmaceuticals as well. And then another problem is microbial pathogens that are found entering surface waters from manure running into a stream, or if there's a lagoon breach or some other problem associated with controlling the manure from these facilities.

HOOD: In your opinion, is there a reasonable and sustainable compromise that could be reached in this situation—that is, between the interests of preserving public health and the environment and economic interests?

THORNE: I think there is. I mean, this is clearly a very important industry to our economy and in terms of food supply, and they should be able to be successful in business. So I think there's several ways we can look at this. One is that, unfortunately, most of the research in livestock production has focused on yield and feed conversion rather than on safety or sustainability, so I think it's time to refocus these dollars on the important health issues associated with the industry that could help ensure the future for

livestock production. And most people, I think, agree that we should be able to provide high-quality meat at an affordable price without compromising human health or environmental quality.

A second thing is that some of the research that has been done points to some changes that we could make in terms of different best practices in the industry. So one example that's very simple is knifing manure in beneath the soil at a time when that can be utilized for growing crops, as opposed to aerial spraying or storing this in manure lagoons. Another area where there's ample research pointing to controlling effluents is to use bioreactors or filters, basically, that use microbes to remove the dangerous gases that emanate from these facilities. These are technologies that are advanced and economical and can be put forward to the benefit of communities as well as the livestock producers that operate there.

And then I guess one other area I could mention is that instead of using anaerobic lagoons, which produce hydrogen sulfide [and] nitrous oxide, which is a greenhouse gas, we could go to aerobic digesters, which don't produce those greenhouse-forcing gases and better yield a fertilizer that can be sold as a commodity. And by the way, while producers do this, they can sell the carbon credits on the carbon exchange because they're not producing greenhouse gases that otherwise would have been produced, and this can actually turn a profit.

HOOD: Well, it sounds like there are some new developments in the pipeline that will potentially really help the situation.

THORNE: Yeah, I think so, and as we learn more about H1N1^{vii} and the potential role of CAFOs in this,^{viii} I think there will be similar best practices that can be invoked that will help us, and clearly one of those might be not putting these large facilities for poultry next to swine. And I think that over time we can make those changes without much of an impact on the industry.

AHEARN: That was Dr. Peter Thorne talking with science writer Ernie Hood. Dr. Thorne is a professor of occupational and environmental health at the University of Iowa

and is director of the Environmental Health Sciences Research Center there.

And that's *The Researcher's Perspective*. I'm Ashley Ahearn. Thanks for downloading!

References and Notes

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^v Gilchrist MJ, et al. The potential role of concentrated animal feeding operations in infectious disease epidemics and antibiotic resistance. *Environ Health Perspect* 115(2):313–316 (2007); doi:10.1289/ehp.8837.

^{vi} Donham KJ, et al. Community health and socioeconomic issues surrounding concentrated animal feeding operations. *Environ Health Perspect* 115(2):317–320 (2007); doi:10.1289/ehp.8836.

^{vii} At the time of this recording in October 2009, pandemic novel influenza A (H1N1), or swine flu, was in full swing. By late summer 2010, when the virus was declared to be post-pandemic, more than 214 countries and overseas territories or communities had reported laboratory-confirmed cases of pandemic influenza H1N1 2009, including more than 18,000 deaths (WHO. Pandemic (H1N1) 2009—update 112. Geneva, Switzerland: World Health Organization (2010). Available: <http://tinyurl.com/6jh6bx9> [accessed 22 Feb 2011]).

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Ernie Hood is a science writer, editor, and podcast producer in Hillsborough, North Carolina. He also produces and hosts the weekly science radio show *Radio in Vivo*.